



Osteoporosis and Bone Health

PATIENT EDUCATION SERIES

What is osteoporosis?

Osteoporosis, which means “porous bones,” is a condition of the skeleton in which the amount of calcium present in the bones slowly decreases to the point where the bones become less dense and more prone to fracture. Contrary to popular belief, it is not just a disorder of the elderly woman. It can occur in the college-aged population. People with eating disorders, high performance athletes or patients on certain medications may be at the greatest risk. Even if you have no present high risk factors, building strong bones today may prevent osteoporosis from occurring in the future.

How does it occur?

Our skeleton provides structural support for our muscles and organs. In addition, it serves as a storage depot for 99% of the body’s calcium. The remaining 1% is free to circulate in the blood and is essential for crucial body functions including muscle contraction, nerve function and blood clotting.

Bone is not a lifeless structure. It is a living, growing tissue. In order to meet our body’s needs it is constantly being remodeled, broken down and reformed again. The breakdown is done by cells known as osteoclasts which dig holes into the bone, releasing the small amounts of calcium into the bloodstream that are necessary for other vital functions. Cells called osteoblasts then rebuild the skeleton, first by filling in the holes with collagen and then by laying down crystals of calcium and phosphorus.

From childhood to adulthood, bone is made faster than it is broken down and bones become larger and denser. Peak bone mass occurs by the mid 20’s. The remodeling process begins to change as early as age 35, so that bone is broken down faster than it is made. This results in precipitous bone loss after menopause. It is crucial that young adults “bank” enough calcium in their bones to draw on later in life to prevent osteoporosis. A person who has exceptionally dense bones to begin with will probably never lose enough calcium to reach the point where osteoporosis occurs. However, a person who has low bone density could easily develop osteoporosis despite losing only a relatively small amount of calcium.

Many factors affect the remodeling process. A deficiency of the hormone estrogen appears to increase bone loss. This occurs naturally after menopause but can also occur with surgical removal of the ovaries. Intense exercise such as marathon running affects hormonal levels and may lead to osteoporosis. Severe underweight and undernutrition problems that occur in patients with eating disorders can lead to hormonal deficiencies which cause amenorrhea (absence of menstrual periods) and severe osteoporosis.

What are the signs and symptoms of osteoporosis?

Early osteoporosis may have no symptoms. Symptoms occurring LATE in the disease include:

- Fractures of the vertebrae, wrists or hips following very minor trauma
- Low back pain
- Neck pain
- Bone pain or tenderness
- Loss of height over time (may be as much as 6 inches)
- Stooped posture (“dowager’s hump”)

What factors increase your risk of developing osteoporosis?

For women

- Being female (80% of osteoporosis occurs in women)
- Increasing age: after 65 about 30% of women have osteoporosis
- Being postmenopausal, either due to natural or surgical menopause (decreased estrogen)
- Estrogen deficiency due to abnormal absence of menstruation. This can occur in persons with eating disorders or high performance athletes. In fact, over half of anorexics have osteoporosis with bones resembling those of women in their 70s or 80s.
- Ethnic heritage - Caucasian and Asian women are at highest risk. Risk is lower for African American and Latino women.
- Thin, slight body frame
- Lifestyles that increase the risk of osteoporosis include smoking, alcohol use, high caffeine use, lack of exercise and low intake of calcium and vitamin D.
- Certain medications may increase risk including steroids, excessive thyroid medications, anticoagulants, antiepileptic drugs and immunosuppressants.

- Certain metabolic diseases can cause secondary osteoporosis.

For Men

Men start with higher bone density and lose calcium at a slower rate than women, which is why their risk is lower. However, men can develop osteoporosis. In men, a testosterone deficiency may contribute. Many of the risk factors, such as ethnic heritage, body frame, lifestyle and medication risks listed above, are the same as for women. However, men typically develop osteoporosis at a later age than women (after 60).

What tests can be done to confirm the diagnosis of osteoporosis?

Osteoporosis can be confirmed by bone-density testing. This is usually suggested for women over 65, postmenopausal women with risk factors of osteoporosis or who have had a fracture. Young women who have risk factors for osteoporosis such as having an eating disorder or absence of menstruation from over-exercising should also consider being tested.

Currently, the most accurate technique for determining bone density is dual x-ray absorptometry (DEXA). The measurements are made by detecting the extent to which bones absorb photons that are generated by very low-level x-rays. This test is painless and quick. When the bone mineral density is 2.5 standard deviations below the average for young adults, a diagnosis of osteoporosis is made. If the bone mineral density is between 1 and 2.5 standard deviations below the norm, a patient is diagnosed with osteopenia, a slightly less advanced form of weakened bones. One standard deviation below the norm in a measurement of hipbone density is equivalent to adding 14 years to a person's age-related risk of fracture.

How is osteoporosis treated?

Treatment cannot eliminate osteoporosis, but medicines may be able to slow down the loss of bone. Most of the medicines available today are primarily aimed at treating osteoporosis in the postmenopausal woman. Studies are presently underway investigating therapies for the younger patient with osteoporosis. Oral contraceptives have not been found to be effective in treating osteoporosis due to anorexia. Investigational studies are looking at insulin-like growth factor-1, testosterone, and a postmenopausal osteoporosis medication as possible therapeutic agents for young women.

Increasing calcium intake to 1500 mg per day, increasing vitamin D to 800 IU per day and maintaining normal weight and exercise patterns to restore hormonal balance are thought to be helpful in preventing further bone loss.

Bone Health

How can I keep my bones healthy and strong?

Be sure to get the recommended amount of calcium and Vitamin D. College students should have an intake of 1200 mg of calcium daily. Vitamin D helps the gastrointestinal tract absorb calcium. The recommended vitamin D intake is 400 to 800 IU per day. Although some of our vitamin D is manufactured in our skin after exposure to sunlight, we cannot rely on the sun to produce all the vitamin D we need, especially in northern areas like New England. Diet is the best source of vitamin D. Supplements may be necessary, but vitamin D from all sources should not exceed the recommended limit.

What are the best sources of calcium in food?

Nutritionists believe that it is preferable to choose food over calcium supplements if possible since calcium rich foods contain many other nutrients that work with calcium to keep your bones healthy. Also, calcium from supplements is not as well absorbed by the body as calcium from dairy products.

Milk Group

The milk group is the best source and you should try to get "4 a day." About four servings of dairy (each about 300 mg) approach the daily goal of 1200mg calcium. Women with osteoporosis or osteopenia need 1500 mg calcium daily. Three servings plus a 500mg calcium supplement would also give you the needed amounts. Dairy products are a particularly good source of calcium because they are also fortified with vitamin D.

Appropriate calcium content of selected foods

Milk

All types of milk	1 cup	300 mg
Calcium-fortified soy milk	1 cup	300 mg
Low-lactose milk	1 cup	300 mg

Yogurt

All yogurts	1 cup	300 mg
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(top off your baked potato or add fruit to make a smoothie)

Cheese and Ice Cream

Swiss cheese	1.5 oz	300 mg
American cheese	2 oz	300 mg
Cheddar cheese	1.5 oz	300 mg
Mozzarella cheese (skim) (top off your salad)	1.5 oz	300 mg
Parmesan cheese, grated (top off your pasta)	1 oz	300 mg
Low-fat cottage cheese	1/2 cup	80 mg
Typical ice cream	1/2 cup	90 mg

Meat/Protein Group

Sardines with bones	3 oz.	200 mg
Canned Salmon with bones (good substitute for tuna)	3 oz	200 mg
Almonds	1/3 cup	120 mg
Tofu (calcium-fortified)	1/2 cup	150 mg

Vegetable Group

Kale	1/2 cup	90 mg
Okra	1/2 cup	90 mg
Beet greens	1/2 cup	80 mg
Broccoli	1/2 cup	50 mg

(Dark green vegetables are rich in calcium, but little is absorbed. However, they are a good source of vitamin K, which is also important for bone health.)

Fruit Group

Orange	1	50 mg
Calcium-fortified orange juice (a very well absorbed source of calcium)	8 oz	300 mg
Figs, dried	10	250 mg

Grain Group

Enriched English muffin	1	100 mg
4-inch Pancakes made with milk	2	70 mg
Hamburger bun	1	50 mg
6-inch corn tortilla	1	40 mg
Calcium fortified cereal (Start your day with cereal and milk.)	1 cup	300 mg

Combination Foods

Cheese pizza	1 slice	220 mg
Taco Salad	1	280 mg
Taco	1	100 mg
Caffe Latte	12 oz	400 mg
Caffe Mocha	12 oz	300 mg
Cappuccino	12 oz	250 mg

Should I take a calcium supplement?

- If your typical diet does not allow you to consume enough calcium, calcium supplements should be taken.
- Multivitamins with minerals **do not** have the amount of calcium needed as a supplement.

- Calcium supplements exist in different compounds, all available over the counter. Although all of these provide calcium they have different calcium concentrations, and absorption may differ.
- The best choices for calcium supplements include:
- Calcium citrate or maleate pills, especially those with vitamin D. These are more expensive but are absorbed better in general. There is some absorption on an empty stomach.
- Calcium carbonate pills, especially those that include vitamin D. These should be taken with food in order to be absorbed.
- Chewable forms of calcium, such as “Viactiv,” or similar generic brands.
- Remember that calcium and iron supplements (or vitamins with iron) should not be taken together as the body will preferentially absorb iron and the calcium will not be absorbed.
- If you take a multivitamin with vitamin D, check the vitamin D in your calcium supplement, too - to be sure you are not over 800 IU/day.
- You can adjust your daily intake of a supplement, depending on your dietary intake of calcium foods for the day, to approach your goal of 1200 mg calcium per day.
- Women diagnosed with osteopenia (below normal bone density) or osteoporosis (more advanced bone loss), need 1500 mg calcium per day through diet and supplements.

What else can I do to keep my bones healthy?

- **Get regular physical activity.** Physical activity, particularly weight-bearing exercise, applies tension to muscle and bone which encourages the body to compensate for the added stress by increasing bone density. Activities that involve the repeated action of your feet hitting the ground such as brisk walking, jogging, racket sports or aerobic dancing are the best options. Weight training on resistance machines or with free weights also strengthens bones. Swimming and bicycling promote fitness but they aren't bone builders.
- **Maintain a healthy weight.** If you cut back on food to cut calories, you may come up short on calcium, too.

A Word of Caution: being too thin or exercising too much may change a woman's menstrual cycle (irregular periods or none at all) by affecting hormone levels. Because estrogen helps deposit calcium in the bones, you lose the natural protections that hormones provide against bone loss and increase your

risk for osteoporosis. A return to normal eating and exercise patterns may lead to return of normal menstrual periods and prevent further bone loss.

However, affected women may live the rest of their lives with weakened bones, leading to impaired mobility, chronic pain and deformity.

Avoid smoking. Smoking is bad for your bones as well as your heart and lungs.

Go easy on alcoholic drinks. Excessive drinking interferes with calcium absorption.

Reduce caffeine intake. Two to three cups of caffeinated coffee daily has been shown to contribute to bone loss, particularly if calcium intake is low.

For more information on healthy eating, go to the nutrition section of our Health Education web site at www.brown.edu/healthed.